

ON A CASE OF NATURAL HYBRIDISM IN THE GENUS *GREVILLEA*
[N.O. PROTEACEAE].

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(Plate vii.)

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In the Abstract of Proceedings dated 30th July, 1913, is given a short account of a case of hybridism between two species of Blue Mountain *Grevillea* by the late Mr. J. J. Fletcher. He contended, with many facts, much detail and a large range of specimens, that *G. Gaudichaudii*, R.Br., consists of a series of transitional forms between *G. laurifolia*, Sieb., and *G. acanthifolia*, A.C. That the entire series known as *G. Gaudichaudii* is a series of variable naturally related forms, explainable only as being hybrids between the two other species mentioned. That the two parent-species are markedly contrasted in most of their morphological characters, in their habit of growth, in being members of two different plant associations, consequently in their habitats; cross-pollination being possible, however, by reason of comparative proximity, and because the racemes of both are of the same pattern (elongated, secund and centripetal); moreover, the conditions favouring cross-pollination arise only at or close to the boundary between their respective habitats; consequently they are usually found in company with one or other, or both the parent-forms.

G. Gaudichaudii has no specific characters; being of mixed origin, the characters are inherited, being blends or mixtures of those of the parent-forms. They are the first Australian, Proteaceous, wild hybrids recorded. They are not infertile, but they rarely reproduce themselves, because likely to be overlooked by visiting birds (the natural agents in pollination) or are likely to be pollinated from one of the parent-forms. (C.T.M. and J.J.F.)

Historical.

During the stay of the French corvette *Uranie*, engaged in a scientific voyage round the world, in command of Captain Freycinet, in Port Jackson, in November and December, 1820, Gaudichaud, the botanist of the expedition, made a fruitful excursion to Bathurst. Among the most important botanical additions to his collection was a rare, undescribed *Grevillea*, probably the only plant of its kind seen by him. It was obtained on the Blue Mountains, at "Vallée de Jamison."

¹ This paper is the outcome of an examination of extensive notes on the subject left by the late J. J. Fletcher and has been prepared for publication at the request of Mrs. Fletcher. Having had the opportunity to assist in the field work, knowing Mr. Fletcher's views, having examined the species in the field and worked over the collected specimens, I can endorse fully the detail and conclusions given. Except where indicated, this paper is copied directly from Mr. Fletcher's notes.—C. T. MUSSON.

But Gaudichaud did not go far enough from the Western Road to see the Jamison Valley which, at that time and for long afterwards, was inaccessible from the main road. What he means, we may fairly well conclude, was the little valley and its tiny rill of water visited by C. Darwin.² (It seems quite probable that Gaudichaud when at The Weatherboard on his way to Bathurst took advantage of the short time at his disposal to take the (probably) one walk that presented itself, and which was later taken by C. Darwin. This is an interesting conjecture, and is quite likely correct, for in those early days there were no side roads opened up and any visitor would doubtless be directed, when the coach stopped at The Weatherboard, the old name for Wentworth Falls, to the one track, apparently between what is now known as King's Tableland, and the more westerly spur at the end of which now exists the Wentworth Falls Hotel. The tiny creek runs approximately south from the township and falls over the cliff as described by Darwin. Gaudichaud could not have collected his plant in the Jamison Valley; but on the high ground overlooking it; somewhere along the valley mentioned above.—C.T.M.)

On his return to Paris, Gaudichaud gracefully presented a portion of his specimen to Robert Brown, who subsequently described it in the *Suppl. Prod.* (1830) under the name of *G. Gaudichaudii*, R.Br.

In the meantime the scientific records of the voyage of the *Uranie* had been in preparation and Gaudichaud wished to include a description of his new *Grevillea* in the botanical part of the work, which was eventually published in 1826. This description, the earliest to be published, is usually quoted as if it were R. Brown's.

From a comparison, internal evidence shows it is evidently Gaudichaud's own description that he gives. Brown may or may not have sent him a copy of his proposed description. But as Gaudichaud's specimen was not exactly a duplicate of the one he had parted with, and he wished to figure it, he evidently described his own specimen, adopting R. Brown's name.

Forty years later Bentham redescribed *G. Gaudichaudii* more fully than had his predecessors (*Fl. Aus.*, V, p. 438); but unfortunately for those who came after him, he apparently did not see R. Brown's specimen, nor specimens like them and in drawing up his description he omitted to make provision for any but his own. The consequence is that both the status and the identity of *G. Gaudichaudii* are left in doubt. If we are to take Bentham's description as the standard for determining *G. Gaudichaudii*, then the specimens of R. Brown are not that species, and we are given no clue as to how they are to be disposed of. It seems remarkable that Bentham apparently did not himself realize this anomaly.

Modern Details.

At the meeting of this Society in July, 1910, in response to an invitation issued at a previous meeting asking members who had collected, or who had in their possession specimens of *G. Gaudichaudii*, four members brought specimens, some

² "In the middle of the day (1844) we baited our horses at a little inn called The Weatherboard. The country here is elevated 2,800 feet above the sea. About a mile and a half from this place there is a view exceedingly well worth visiting. Following down a little valley and its tiny rill of water, an immense gulf unexpectedly opens through the trees which border the pathway, at a depth of perhaps 1,500 feet. Walking on a few yards, one stands on the brink of a vast precipice, and below one sees a grand bay or gulf. . . . About 5 miles distant in front, another line of cliffs extends, which thus appears completely to encircle the valley."—Darwin's *Naturalist's Voyage Round the World*, 1845, p. 523.

of them from the Botanic Gardens Collection. The joint collection then exhibited was, almost certainly, the best at the time in Australia. Three collectors had obtained plants which answered to the descriptions of Brown and Gaudichaud; but no plant was produced which corresponded with Bentham's description. Since then I have devoted my brief holidays to the further study of these plants under natural conditions, and have now (1915) a much better collection than that exhibited in 1910; but I have not yet found a single plant to which Bentham's description will apply. Nevertheless I raise no doubt as to the correctness of Bentham's descriptive details, though I think one of his inferences was made under a misapprehension, due to want of knowledge not determinable from the examination of herbarium specimens alone; and that this is open to correction. I believe I am now in a position to offer a solution of the difficulties which arise from the conflicting descriptions.

The Conflicting Descriptions.

The three descriptions mentioned, together with a note by Mr. J. H. Maiden, which was not intended to be descriptive but to put on record some observations of the late Mr. W. Forsyth¹ on living plants, comprise all the literature about *G. Gaudichaudii* available.²

Brown refers to some MS. notes of Allan Cunningham's, at the end of his description in which the species is referred to under the MS. name *G. acanthifolia* var. *quercifoliae*. Unfortunately Cunningham's notes were not published. There is no mention of the species in his "Specimen of the Indigenous Botany of the Mountainous Country between Sydney and Bathurst" (Field, 1825), though *G. acanthifolia* was first described in this paper; or in any other of his published writings as far as I know.

Dr. Woolls and Baron von Mueller, as far as I can ascertain, never found any occasion to refer to it.

In order, therefore, to make clear how some specimens I have now collected come in, in an important way, I preface an account of these with a brief statement of the whole case, based chiefly upon a comparison of the descriptions of *G. Gaudichaudii* by Brown, Gaudichaud and Bentham, supplying necessary comments.

Though not first in chronological order, I begin with R. Brown's description.

One minor correction needs to be made, otherwise the description is satisfactory as far as it goes; having no knowledge of the habit of *G. Gaudichaudii*, he naturally took the spikes to be erect. The plants are prostrate, as pointed out in Mr. Maiden's note, and the spikes are more or less horizontal as in *G. laurifolia*; and, as in that species, frequently rest upon the ground.

From a comparison of the descriptions of *G. Gaudichaudii* and *G. acanthifolia*, it is evident that R. Brown considered *Gaudichaudii* to be distinguishable from *acanthifolia* by the scattered appressed hairs on the underside of the leaves, by their simpler lobing, by the presence of an intra-marginal vein, by the racemes not being so dense and by the perianths having less clothing (sericeous as compared with very villous). The term sericeous, however, in the specimens I have seen applies only to the white silky hairs; but besides these there is some hairiness tinged with the colour, dark crimson, of the perianth as in *G. laurifolia*. If the white silky hairs could be removed the perianth would not be glabrous.

¹ These PROCEEDINGS, 1904, p. 749.

² Written between 1913 and 1918.

From my point of view, the condition in question is the result of a mixture of the corresponding characters of *G. laurifolia* and *G. acanthifolia* when these two species are crossed.

One other point, the lobes of the pinnatifid leaves are described as entire, a character in which R. Brown's specimen differed from that described and figured by Gaudichaud. Portions of plants showing this character may be procured without difficulty, but in all plants of the *Gaudichaudii* group (see ii below) that I have seen, if all the leaves are examined, some of them will be found to offer indication of secondary lobing. Brown's and Gaudichaud's specimens may, therefore, have been different portions of the same plant, and yet offer the differences recorded. Finally R. Brown definitely recognized that the racemes and flowers were not exactly like those of *G. acanthifolia*.

Turning to Gaudichaud's description (he saw both species in the living condition), it is evident he did not copy the descriptions of Brown, but drew up his descriptions independently. He recognized, like Brown, the differences in the indumentum of the leaves, in the lobing of the leaves, in the clothing of the perianth (sericeous in one case, tomentose in the other), but he used the wrong adjective in both cases in describing the pistils; the styles are glabrous in both cases, but the ovaries are villous in both cases.

A very interesting and important omission, however, is that of the presence of the intra-marginal vein. If he had had the opportunity of seeing the leaves of *G. laurifolia* (which he apparently did not collect), its presence might have struck him. From this omission, and the mistake about the pistils, as well as in other small details, it seems clear to me, that R. Brown did not write this description, and that in all probability Gaudichaud did not see a copy of R. Brown's before his own was published. He gives a good figure of a portion of a stem or branch with nine leaves, having 5, 7, 8 and 9 lobes; and two spikes which are evidently not exactly like those of *G. acanthifolia*; whilst the ovary is correctly figured as villous (*Frey. Voy. Bot.*, p. 443, and Plate 46).

Turning now to Bentham's description it appears that the plants to which it applies are not known to local collectors; it may be that they are a second cross between one of the ordinary forms and a hybrid.

Some Indirect Evidence.

In the neighbourhood of Sydney it is easy to find plants of two or more different species of *Grevillea* flowering at the same time and fruiting freely, growing close to each other under conditions apparently quite favourable to cross-pollination by nectar-seeking birds. Nevertheless transitional forms between such species have never been reported. They do not seem to be produced in the cases examined, apparently for reasons given below.

For some years I have had an excellent opportunity of periodically inspecting an extensive crop of thousands of specimens of the two species *G. sericea* and *G. buxifolia*, the former more numerous than the latter, crowded together on a ridge overlooking the Lane Cove River, 200 to 300 yards wide, it terminates abruptly on the east. Half a mile west the Hawkesbury sandstone is overlaid by Wianamatta shale, with a corresponding change in vegetation. This ridge was swept by a destructive bush fire on 2nd January, 1909, a phenomenally oppressive day with hot westerly wind. In due course, after rain had fallen, seedlings came up in great profusion, especially so *Grevilleas*, which grew rapidly, got ahead of the more slowly growing plants and temporarily took charge of the area. So

numerous were they that one could walk down one side of the ridge and up on the other or zig-zag in any direction and yet keep one hand on one or more plants all the time. The two species mentioned were flowering side by side, their branches overlapping, so that the racemes of one were sometimes only a few inches from the other. Seven capsules to a raceme were quite a common occurrence. The plants are so different that they are readily distinguishable at sight at any stage of growth. I was interested in the renascence of the vegetation on this circumscribed spot, having had the Grevilleas continuously under observation from the time they were seedlings, yet I never succeeded in finding a single plant that was not certainly determinable as one or the other. There appeared no evidence whatever of any kind of successful hybridization, nor was there, as far as I have observed, in a fresh crop of seedlings that came up. I am therefore led to conclude that the Honey-eaters cannot cross-pollinate them.

Elsewhere *G. punicea* and *G. buxifolia*, *G. sphacelata* and *G. sericea*; and on the lower part of the Blue Mountains *G. phyllioides* and *G. parviflora*, may be found growing together under conditions which seem to be favourable for crossing, but apparently without any such result. It may be that the pairs of species enumerated are infertile, *inter se*; that is a matter for experimental investigation.

There is another possible explanation, which may be the correct one. Reference to the *Flora Australiensis* shows that the species of every pair referred to are placed in different sections of Bentham's Table; in other words the racemes are of different patterns or there are structural peculiarities of some sort present in one and not in the other. The result probably being, that a nectar-seeking bird visiting the flowers of one species may carry the pollen away from flowers on one part of the head, their position not matching with that of the receptive stigmatic surface of the other species. The result would be that cross-pollination of other flowers in the same or in other racemes of one type could take place, whilst in other species with raceme types differing it could not be effected.

Experimental investigation into these interesting details is much to be desired. At present we have little or no data for consideration.

(It has been observed that Honey-eaters commonly make a practice of commencing with the lower flowers of a raceme, working upwards. This would favour cross-pollination in the case of *laurifolia* and *acanthifolia*, as in both species the flowers open centripetally. In the case of *sericea* and *buxifolia*, one opens centrifugally, the other centripetally, a fact which would tend to prevent crossing.—C.T.M.)

Some Detail as to the Three Species from Fresh Specimens, 1913.

G. laurifolia (Plate vii, fig. 1.)

G. laurifolia (Plate vii, fig. 1) belongs to the xerophytic plant association which successfully occupies the poor soil of dry situations in the Hawkesbury Sandstone series (approximating to the Bunter Sandstone of the Trias). It certainly occupies some very dry positions on the ridges or on more level areas on the top of the tableland, where the ground must be so sunbaked and hard in droughty summers, that when heavy rain falls comparatively little can be stored as it runs away so rapidly. On the other hand mountain mists, which are not infrequent, may be helpful.

These plants are prostrate in *habit*, with several radiating procumbent stems arising from a thickened base. These stems are often 8-10 feet long, wiry and flexible, and readily made up into a small coil (except when very old); they are

well branched and very leafy, forming carpets lying close to the ground. In very old plants the basal thickening forms a large knob and the stems arising from it may be an inch in diameter or more for some feet from the base.

The *leaves* have a characteristic venation and indumentum, and cannot be mistaken for any other local plant. They are distinctly thicker than those of *G. acanthifolia*. Petiolate, entire, they vary a good deal in shape and size, according as they are well exposed to the light, or shaded by grass, shrubs or trees. They may be ob-lanceolate, long and narrow, short and broad or broadly ovate, even almost circular, and mucronate. Glabrous above when adult, very young leaves and shoots are thickly coated with a mixture of silky white and ferruginous or reddish appressed hairs lying very close together. Those of the upper leaf surfaces are soon lost. Except the midrib the under surface is thickly coated with silky white hairs lying close together and doubtless of use in checking transpiration as well as serving to protect the stomata from dust, or soil washed down by rain. The veins are very conspicuous, nearly parallel on each side of the midrib. They end distally in a characteristic well-marked intra-marginal vein.

The *perianth* tube, viewed from outside, has much more colour than in *G. acanthifolia*, and this is all the more evident because most of the appressed hairs clothing the tube are dark crimson or ferruginous, only a few white hairs being mixed with them. The hairs appear as if plastered down, not merely appressed. *Racemes* of very young unopened buds, with the bracts *in situ*, may have the globular limb, and that part of the limb not hidden by the bracts, ferruginous or rusty; or they may be turning crimson, though with a distinctly ferruginous tint on the globular limbs. The *bracts* are yellowish, coated with yellowish or rusty and white hairs. The *rhachis* is also thickly coated with short crimson, ferruginous or rusty appressed hairs. As the tube dries the colour sometimes becomes almost magenta. In still older buds in which the bowed style has not yet begun to protrude from the flowers, the tubes of the perianths, and the pedicels, are more distinctly crimson, but the globular limbs are still ferruginous, to the naked eye contrasting in colour. The rhachis may have more evident crimson hairs mixed with ferruginous or rusty hairs; while the bracts may be yellowish, or tinged with crimson near the base or over the greater part of their surface. In still older *racemes*, in which the bowed styles of the lowest flowers are protruding, there is still a noticeable contrast between the colour of the tubes, and of the globular limbs; and so much of the inner surface of the limb as is exposed, is seen to be edged with dark crimson, in still older flowers changing to purple. This may be confined to the free edge of the split perianth leaving a yellow gutter between, or the whole of the exposed inner surface may be purple, becoming darker as the flowers mature; eventually fading to some shade of dark red in dried flowers.

In mature flowers the globular limb and tube still show the difference—crimson—ferruginous. The *pedicels* are same colour as the perianth—rusty. In some racemes the flowers remain ferruginous without change, in others one-half longitudinally is crimson, the other ferruginous. Stipes of the ovary is longer than in *G. acanthifolia*. Styles lighter crimson, stigmatic disc green, sometimes crimson. Freshly exposed pollen is bright yellow and floury, contrasting strongly with the crimson. Hairs on the ovary and the stipites not so numerous as in *G. acanthifolia*, usually white mixed with crimson, or they may be nearly all crimson with just a few white. I think the hairs of the tomentum are correctly described as appressed all over (on tube and limb). The perianth and globular limb split on the lower

side (Bentham), the latter nearly to the base to allow the exit of the pollen-carrying disc, while the two laminæ of the limb usually cohere on the upper side. When exposed in this way the inner surface is purple or there is a purple stripe on each side with an intervening longitudinal yellowish area along the coherent margin extending for some distance below the revolute limb but not to the base. The purple colour is evanescent, changing to dark crimson.

G. acanthifolia. (Plate vii, fig. 6.)

This species is tolerant to any amount of water applied to the roots; it belongs to a mesophytic assemblage of plants which flourish in wet swampy areas mainly caused by soakage from springs. Such areas are noticeable from a distance because of the absence of trees, and their green appearance. They are often mentioned by early explorers as they offered chances of feed for their horses or bullocks when there was nothing to be had elsewhere. They occur at different levels, frequently on the slopes of shallow valleys or bordering creeks,¹ sometimes they surround small islands of drier ground on which a few trees may occur. They are to be found only in the upper portions of the tributary valleys of the Grose and Cox rivers. Further down the valleys are enclosed between precipitous cliffs, and this, with absence of sun, profoundly alters the conditions for plant life.

In very dry seasons these areas dry up on the surface and are often burnt over. If the Grevilleas are only well scorched, the portions above ground die, but after sufficient rain they again send up shoots from the thickened base.

G. acanthifolia also flourishes on the banks of creeks, close to the water; and it is not unusual to see some of the main roots actually trailing in running water. It occurs also in depressions near and along the course of creeks, supplied from the overflow after heavy rains.

It sometimes occurs in unusual situations. I have seen one flourishing on the side of an apparently dry embankment leading to a bridge crossing a creek, and growing close to a plant of *G. laurifolia*. Possibly when rain falls the embankment is capable of absorbing more moisture than one might expect; perhaps much more than the sun-baked virgin ground which had never been stirred by spade or plough, but in which *laurifolia* can flourish.

Notes on Fresh Specimens, March and November, 1913.

Leaves: Trifid leaves sometimes subtend an inflorescence. Have seen 3-19 lobes; intermediate numbers commonest. There is an intra-marginal vein (or perhaps an epidermal thickening) to the lobes, *but it is not visible on the under-surface*; nevertheless, when held up to the light, it is visible like the ordinary veins (anatomical examination is wanted here). Seedling leaves, and leaves of side shoots, also the lowest leaves near the ground, of adult plants have relatively much more lamina, and are more easily pressed flat, not being so rigid.

Shoots: Young shoots, and unexpanded young leaf-masses, are coated with white silky hairs on both sides but not the upper surface of the young leaves, as in *G. laurifolia*. This is not mentioned in the *Flora Australiensis*.

Spikes: Not truly secund at first, when young there are bracts all up the rhachis (or all round). That is on the *back*, or the inner side not exposed and facing the stem. As the flowers expand, they reach out towards the light; but even then there are bracts on the back.

¹ This is what A. Cunningham means when he says of this species that its habitat is "wet, peaty bogs on the Blue Mountains."

Flowers: In very young spikes, before the styles protrude, the flowers, like the exposed surface of the bracts and the rhachis, are silky white, due to the hairs, and show no colour, or very little. The bracts are greenish or yellowish green on their inner surfaces. The bowed styles are rich pink; before they appear a little colour shows in the perianth, but it is masked by the silky hairs. In older spikes, it is to the massed styles the colour of the spikes is chiefly due, as seen from a distance, a fact not usually recognized. As the flowers mature, the colour of the styles fades to a lighter pink. At any time, viewed from outside, the perianths show but little colour. But when the styles are nearly ready to straighten, and afterwards, the inside of the perianth, viewed from front or above, is a rich purple (sometimes looking almost black), fading to purplish red in dry (herbarium) specimens. It fades considerably and what is left appears as longitudinal streaks (about ten). In herbarium specimens the colour of the inside of the perianth is perhaps more noticeable than in the fresh state; possibly due to disarrangement and flattening of the silky hairs in the process of drying. The perianth limb looks greenish outside, notwithstanding the coating of white silky hairs, this silky indumentum being most conspicuous. The hairs are appressed, projecting and rather tufty on the revolute limb; after the stigmatic disc has been released they appear as a very noticeable tuft on each side of the expanded revolute limb. The tube of the perianth of young flowers in bud, bracts and rhachis all appear of the same colour when fresh. Flower pedicels are greenish (like rhachis and bracts) and coated with white hairs, when fresh. The pollen masses when freshly exposed on the stigmatic surface are pink, those of *G. laurifolia* and the hybrid (*G. Gaudichaudii*) are bright yellow. The stigmatic discs are light green, fading to yellowish green.

The Hybrids (Plate vii, figs. 2-5). Fresh flowers November, 1913.

With the exception of one plant, I have not seen spikes and flowers of any of the *Gaudichaudii* series, that were not readily distinguishable from those of *acanthifolia*. But I have had the great advantage of examining fresh as well as dried flowers. Plants of Section i have flowers and spikes like *G. laurifolia*, a little lighter in colour in some, but still some shade of crimson, with the same noticeable contrast between the tube and the globular limbs of the perianth (crimson as compared with ferruginous), but with a noticeable increase in the white silky hairs on the tube giving this a sericeous appearance. The inner surface when exposed purple. Plants of Section ii show a good deal of difference in the amount of colour in the perianth, some having very little (not more than in *acanthifolia*) when growing covered up in the shade, except as regards the purple inner surface, when the styles are hardly darker than those of *acanthifolia*. In others there is more diffused colour, lighter than in *laurifolia*, the exposed inner surface purple, when the limb and tube split. The pedicels are green as in *acanthifolia*, but what readily distinguishes them from that species is the admixture of white and crimson hairs on the limb, and white and ferruginous hairs on the globular end. The tomentum as a whole is also more copious and longer on the globular end. Even in dried specimens the contrast is strikingly obvious. The rhachis and bracts are also distinguishable from their rusty appearance due to the admixture of white and rusty or ferruginous hairs. This admixture of the different kinds of hairs on the flowers, rhachides and bracts is perhaps one of the best examples of mixed characters in these hybrids; apparently analogous to the case of hybrid roses between parents having either glandular or non-glandular hairs, mentioned

by Kerner.¹ The tomentum, as a whole, is more copious than in *laurifolia*, but less so than in *acanthifolia*; the hairs are somewhat longer than in *laurifolia*, not quite so long as in *acanthifolia*. The hairs on the ovary are more numerous, and the tuft is denser than in *laurifolia*, being very like *acanthifolia*, but in many cases there are a few crimson hairs mixed with the white.

Classification of Hybrids (G. Gaudichaudii).

The series of hybrids met with, comprises recognizably different types of individual plants. The series, as known to me (J.J.F.) is divisible into two sections according as the plants have entire mixed with pinnatifid leaves, or all leaves are pinnatifid, as in *G. acanthifolia* the number of leaf lobes is not constant. With this difference in leaf character there are correlated certain differences in flower character.

Fresh flowers are only available during the summer months, whereas plants may be seen in leaf through the year, therefore the leaf characters most readily catch the eye. I have had specimens, illustrating a series of stages commencing with *laurifolia* and ending near *acanthifolia*, whilst the reverse could also, necessarily, be illustrated. A short account of various types will show how the characters of the parent species are blended, also indicating something of the variations to be seen, pointing conclusively to their hybrid nature.

Section i: Prostrate plants with procumbent stems. Entire leaves altogether of the *laurifolia* type, mixed with pinnatifid leaves with lobes numbering up to 9, all the lobes entire. Flowers indistinguishable from *laurifolia*, or with more white appressed hairs on the tube of the perianth. Habit like that of *laurifolia*.

- A. Entire leaves most numerous with pinnatifid leaves usually having not more than three-lobes (very rarely four). Flowers and inflorescence indistinguishable from those of *laurifolia*.
- B. Entire leaves in a minority, pinnatifid leaves, up to five lobes; venation and indumentum of *laurifolia*; tube of perianth with more white hairs.
- C. Like B, but indumentum reduced to a remnant of scattered appressed hairs occurring singly, so that underside of leaves is almost glabrous, much as in some plants of A.
- D. Entire leaves more reduced in number mixed with pinnatifid leaves, having 2-7 or any intermediate even number of lobes, indumentum well developed in some specimens.

Section ii: Prostrate plants with procumbent stems, stiffer than in *laurifolia*, and not forming such leafy carpets. All leaves pinnatifid, with from 3-15 lobes (maximum and minimum not found on same plant). Some leaves with entire lobes, but in every plant seen, some bilobed. Three and four lobed lobes may occur, occasionally with bilobed on the same leaf. Indumentum very variable, well

¹"The cellular structures produced from the epidermis of the stem and leaves which are differentiated as hairs, bristles, scales, glands *et cetera*, classed together as under the name of indumentum, are very constant characters in most species of plants. Hybrids exhibit the most varied combinations of the indumenta of their parents. In the majority of cases the characteristics of the two stocks in this respect are mixed, but less frequently they are united, and in the latter case the shape, size and number of hairs . . . are intermediate between those of the appendages in the two parent species."—Kerner and Oliver, *Nat. Hist. of Plants*, p. 564.

"Where one parent rose bears only non-glandular and the other only glandular hairs, the hybrid is sure to be clothed with a mixture of the two kinds of hairs."—*Ibid.*, p. 564.

"The colour of the flowers in hybrids is usually the result of a *fusion* of the colours in the parent species; less frequently it is a *mixture* of the original colours."—*Ibid.*, p. 567.

developed and much reduced on the same plant. Intermediate in extent on others, or reduced generally, on the leaves to a functionless remnant of appressed hairs, singly scattered; recognizable but vestigial. No plant seen with under surface of leaves entirely glabrous.

Fresh flowers with more white silky hairs on tube of perianth, hiding the colour and giving dried flowers a greyish appearance. On the revolute limb of the perianth the hairs are tinged with ferruginous or reddish colour. Capsules hardly distinguishable from those of *acanthifolia*.

E. Leaves with from 3-11 lobes, the maximum of indumentum for this section, but it varies in amount on leaves of the same plant.

F. (Here is *G. Gaudichaudii* R.Br.). Leaves with from 3-11 or 5-15 lobes, with a maximum of bilobing; indumentum recognizable but vestigial, reduced to a few scattered hairs. Perianth with the tube sericeous, the hairs on the revolute limb tinged with ferruginous or reddish. *This is the type of hybrid most frequently met with.*

G. Leaves with 7-13 lobes (or any intermediate even number), with most (but not all) leaves having a maximum of secondary lobing; some trilobed, rarely four lobed. No five lobed lobes seen.

Remarks on the Various Types of the Series.

A. If the pinnatifid leaves are removed, it will pass as a specimen of *G. laurifolia*. If it were the only member of the series known, it might be regarded as a sport, perhaps due to bud variation. Fine colonies of *G. laurifolia* carpeting considerable areas of ground may be found too remote from plants of *G. acanthifolia* for birds to pass directly from one to the other, but in such cases the plants show no tendency whatever to produce lobed leaves. Fourteen plants of this type seen; from the conditions under which they were growing, I believe them to be seedlings from ovules of *G. laurifolia* fertilized by pollen of *G. acanthifolia*.

One fine plant was growing in the midst of a carpet of *G. laurifolia*, and, except in one instance, the others were growing quite close to, side by side with and the branches overlapping, or a little lower down a slope than, one or more plants of *G. laurifolia*. In some cases they were the only hybrids to be found in the locality. In one case only was a plant solitary, and this must have been a case either of a seed having been removed further than usual from the parent form, or more probably was a plant whose former associates had been removed by fire or accident.

B. Six plants have been examined. The finest example was growing on a grassy slope, well exposed to the sun, just below, several plants of *G. laurifolia* with plants of *G. acanthifolia* a few yards away at the bottom of the slope. Another was one of a row of four contiguous plants; the two middle ones were examples of type C. The remaining one of the four a fine example of type F. Two others were growing close to plants of *G. acanthifolia* and the sixth quite close to a group of plants of that species.

C. Two plants only seen, the two referred to above. Both old, very dry and quite alike. Dried leaves appear almost glabrous, but the scattered hairs readily seen on fresh leaves. They had a very distinctive appearance. The leaves, even when fresh, were incurved at the edges in an unusual manner. The facies of these two plants suggested the idea that they were suffering from excessive transpiration due to the loss of the indumentum.

D. Three plants seen, all, I believe, seedlings from *G. laurifolia*. One was growing in the midst of a carpet of *G. laurifolia*, another was beside a plant of that species, the branches overlapping. The third was growing in a grassy glade, near some other hybrids, but with plants of both *G. laurifolia* and *G. acanthifolia* close at hand.

E. Two plants seen, both remarkable for the well developed indumentum and for its variable amount. One plant showed great variety of lobing in the leaves. The other was overshadowed by a plant of *G. acanthifolia*, and hampered in symmetrical growth by other plants. A well marked intra-marginal vein present. But for the indumentum, this plant was quite of the F type.

F (= *G. Gaudichaudii*, R.Br.). The commonest type met with, about fifty plants seen. Not only is this the type most frequently produced, but in my opinion it is the reciprocal hybrid. Solitary plants were seen in the midst of carpets of *G. laurifolia*; others were seen growing close to, even overshadowed by, a plant of *G. acanthifolia*. Others were growing on slopes between *G. laurifolia* above and *G. acanthifolia* below. On the whole they are most frequently situated near plants of *G. laurifolia*. Mr. Forsyth noted this close association with *G. laurifolia*, but without realizing its significance. The reason, as one can see, is that when the birds¹ travel up the valleys visiting *G. acanthifolia* in the swampy lower parts first, and come to the last of them, they very naturally visit *G. laurifolia* on the slopes above, if there is a display within sight. On the other hand, after visiting the *Banksias*, *Lambertias*, and other plants on the ridges and upper slopes they work down over the *laurifolia* areas until they reach the wetter lower slopes where *acanthifolia* flourishes; they may then pass direct from the former species to the latter.

G. Five plants seen, two of them fine plants, one with stems seven feet long, growing in the midst of a carpet of *G. laurifolia*; another near a plant of type B, close to plants of both parent species. A fourth was growing between plants of the two parents. The fifth, a solitary plant, growing further from the parent forms than usual; but there was evidence of interference with the surface.

Summary.

Grevillea Gaudichaudii, R. Br. is a hybrid. The parents are *G. laurifolia* Sieb. and *G. acanthifolia*, A.C.

The forms described by R. Brown, Gaudichaud and Bentham are representatives of naturally related forms, the result of hybridization; and fill places in a graded series between the parents.

These plants are only found near one or both parents, along the Blue Mountains from Wentworth Falls to Blackheath. (The area west of this has not been searched.)

The characters of *G. Gaudichaudii*, R. Br. are blends or mixtures of those of the parent forms.—C.T.M.

EXPLANATION OF PLATE VII.

1. *Grevillea laurifolia*, Sieb.
- 2-5. Various forms of *Grevillea Gaudichaudii*.
6. *Grevillea acanthifolia*, A.C.

¹ The Spinebill chiefly.